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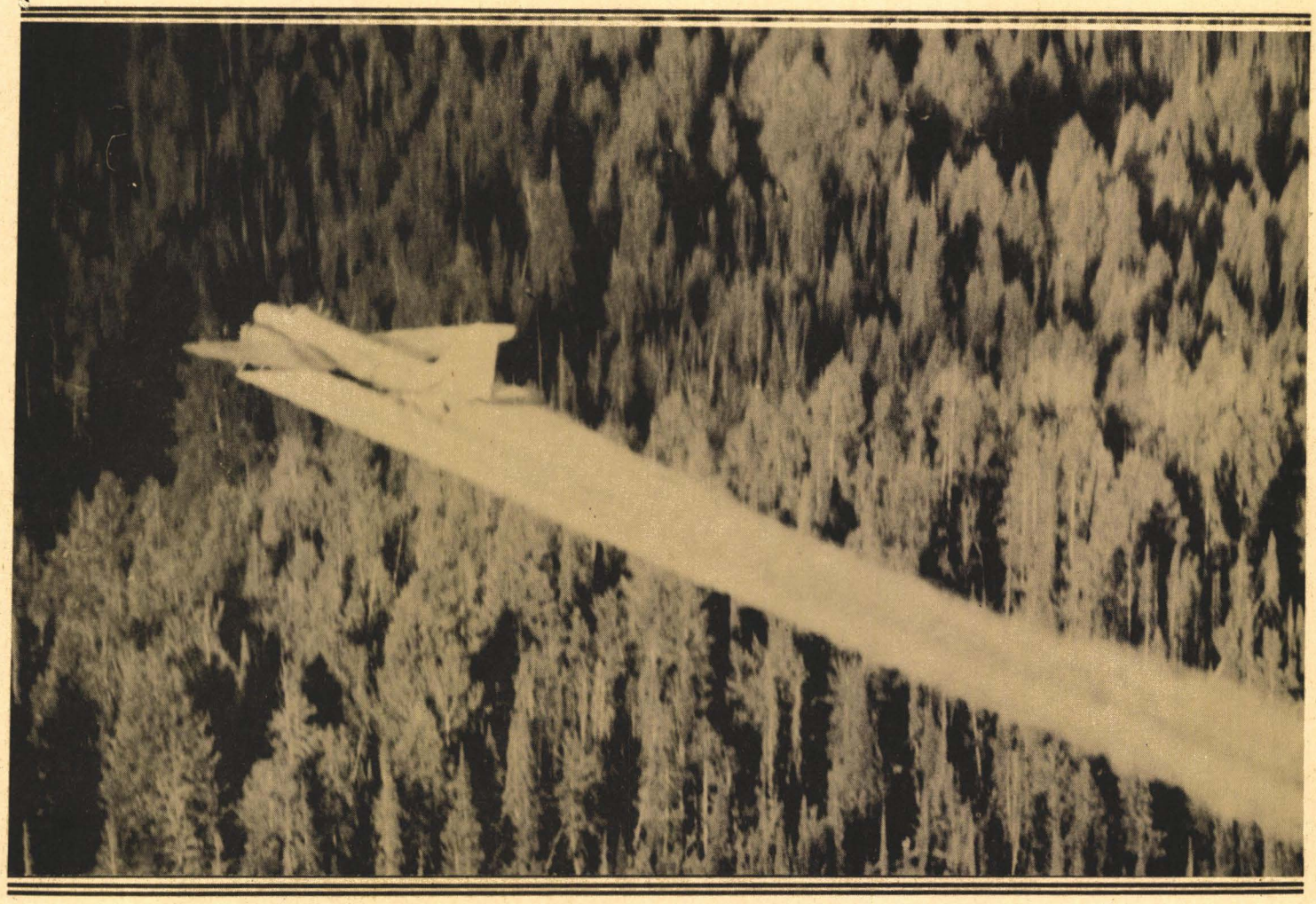

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SPRUCE BUDWORM CONTROL PROJECT

U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE

INTERMOUNTAIN REGION - OGDEN, UTAH

SPRUCE BUDWORM CONTROL PROJECT REPORT

1956

ADMINISTRATION BY INTERMOUNTAIN REGION

TECHNICAL GUIDANCE BY

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

WITH COOPERATION FROM

STATE OF IDAHO DEPARTMENT OF FORESTRY

SOUTHERN IDAHO FORESTRY ASSOCIATION

AGRICULTURAL RESEARCH SERVICE

CIVIL AERONAUTICS AUTHORITY

U. S. WEATHER BUREAU

IDAHO DEPARTMENT OF AERONAUTICS

FOREWORD

The spruce budworm infestation on 475,901 acres of spruce-fir stands in southern Idaho forest areas was successfully treated by aerial control.

This intensive control program involved five national forests and included several thousand acres of State and private lands and was administered with the complete cooperation of many agencies, both private and public. The State of Idaho Forestry Department paid for their proportionate share of all state and private lands treated. Due credit is hereby extended to all participating groups and individuals.

Safety cannot be over emphasized. Completion of the project without any personal injuries indicates to a large degree the professional skill of all the flying personnel and the hearty cooperation of all participants.

Contractors furnishing facilitating services and supplies were most cooperative in every way. Project administrators were unanimous in expressing commendation to all contractors and their personnel for their outstanding service.

The report which follows outlines the major features of the control operation.

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INTRODUCTION

Forest entomologists have recognized a marked increase in the population of spruce budworm (Choristoneura fumiferana) since early summer 1952. Despite successful aerial control of 989,000 acres of spruce-fir forests in southwestern Idaho during the field season of 1955, this insect has continued its epidemic rise on approximately 500,000 acres of new infestation.

Entomologists of the Intermountain Region determined and recommended the control area on the Salmon, Boise, Challis, Targhee and the Payette National Forests for the 1956 aerial control project.

Approximately 3.65 billion board feet of timber, estimated to have a stumpage value of about $10,950,000 and a lumber value of $255,801,201 was threatened by this insect.

In addition to the potential loss of considerable timber values, very important watershed and recreation resources were also threatened.

Funds for the necessary control program on Federal lands were appropriated by Congress under authorization provided by the Forest Pest Control Act. The State of Idaho provided funds to control the epidemic on state and private lands.

STATISTICAL SUMMARY

Total Project Cost		$406,900.00
Total Project Acreage		475,901
Federal	448,631	
State	22,960	
Private	4,310	
Total Cost per Acre		$ 0.855
Total Gallons Insecticide Purchased		483,604
Total Lost Time Accidents		None
Degree of Success (budworm mortality)		92.20%

ORGANIZATION

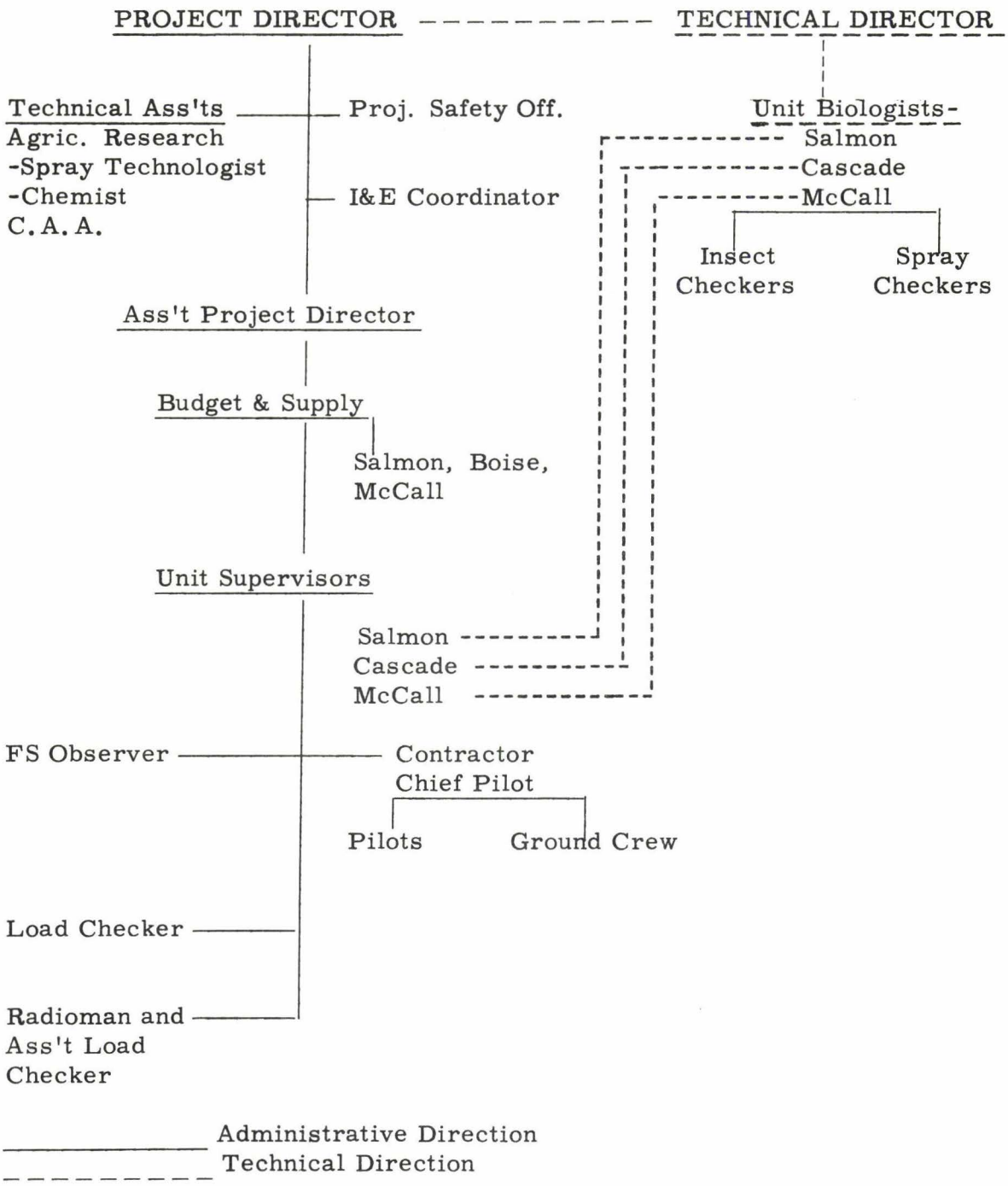
The control project involved five national forests but was organized as a single operation under a project director and a technical director working as a team. Individual forests and the Regional Office were designated servicing functions as determined by the project director. Appointment of key personnel was begun in January and completed shortly thereafter. Planning, organizing, and training phases were actively operating from January to the initiation of the project in June.

The life cycle of the spruce budworm and its extremely short period of vulnerability to aerial spray necessitated very close correlation between the project technicians and the administrators. Insect development dictated control action in every phase of the project and entomological information was funneled through the biologists and their crews to each unit supervisor.

The technicians and their crews also checked spray deposition and insect mortality within the spray blocks to determine coverage and insect kill success. These crews were in the field by June 1st.

Key project personnel were obtained from the various forests concerned. Temporary people were carefully selected from the Boise and Payette National Forests. Assignments were made as indicated on the following organization chart.

PERSONNEL ORGANIZATION CHART



Cooperation of the forest personnel with the project personnel was outstanding and necessary for the completion of the project.

PLANNING

Preparation of detailed plans, information sheets, maps and aerial photographs was begun in January well in advance of the anticipated date of spraying. Bid specifications were prepared in conjunction with Region One.

Plans included instructions and specifications for all phases of the job from the beginning to the end were ordered or arranged for well in advance of the spraying operation.

Original planning was based on an estimate of 452,000 acres. New entomological information received a few weeks prior to the starting date required some last minute adjustments in supply and map preparation work.

Hot dry weather in May followed by above normal temperatures in June hastened the anticipated starting date by two weeks. The weather turned cool and insect development was slowed down until the second week in July when high temperatures again prevailed. The remainder of the area then developed at a rapid rate. The higher elevations were eratic with developments from the second instar to pupation occurring most rapidly.

Spraying operations on the Salmon Unit began on June 25. The McCall unit started the following day. Higher elevation areas slowed insect development in the Cascade unit until July 5th.

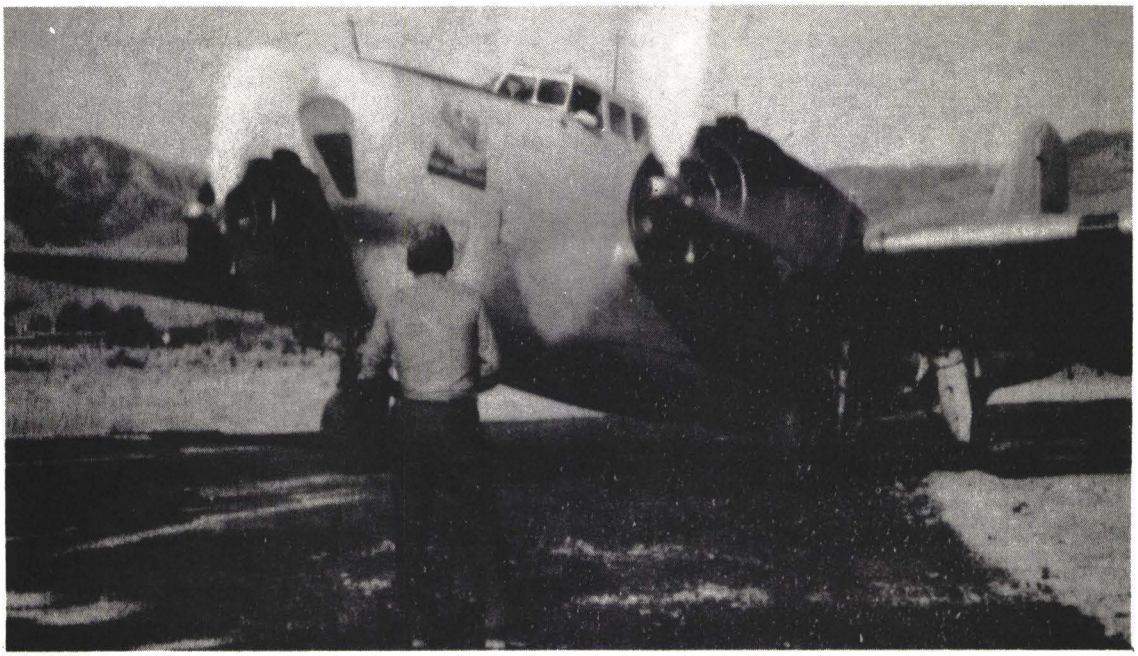
Safety meetings were held on scheduled days each week at each field. All personnel--contractor and Forest Service--participated. Safety features were analyzed and discussed. This contributed to both the safety and the administration of the project.

SAFETY

Safety features which pertained to the flying, equipment and fire fighting were written into the contracts. A safety plan which incorporated all the features in the contracts as well as analysis of the hazards inherent in aerial spraying was prepared in detail. Strict adherence to these safety clauses was insisted upon by all the project supervisory personnel with the result there were no personnel injuries.

An informal safety meeting was held on a scheduled day each week at each airstrip for all contractor and forest personnel. An appointed safety committee led the discussion and each individual was invited to participate and make suggestions.

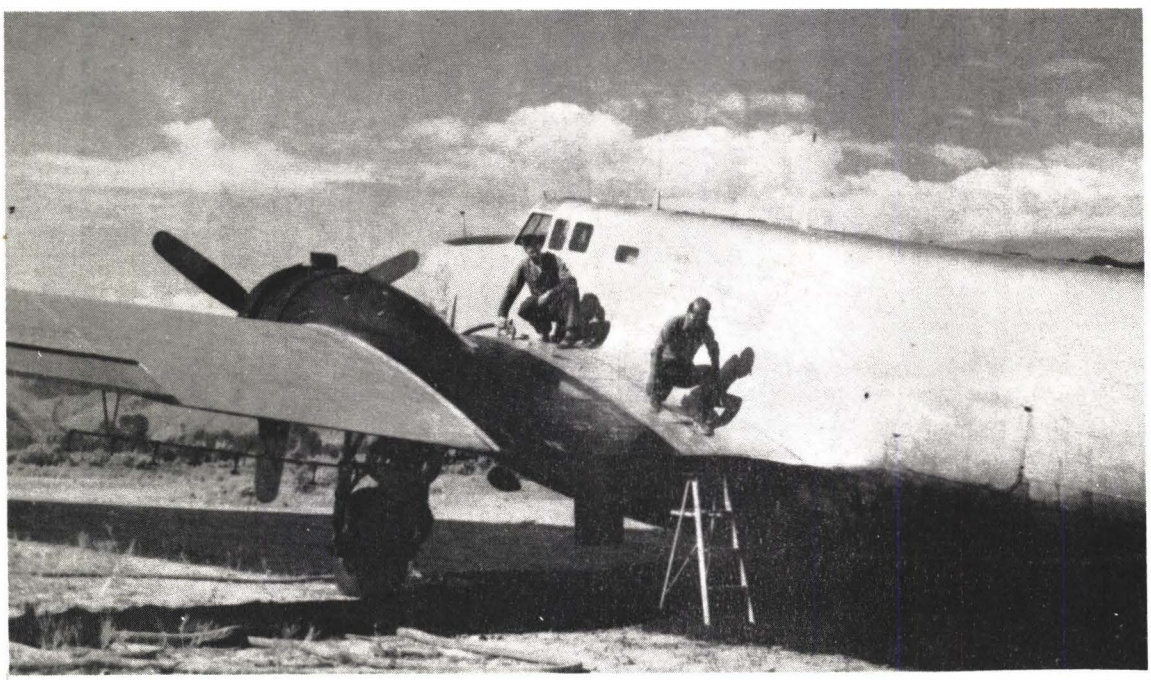
First aid equipment was distributed in strategic locations throughout the spray areas. Organized smoke jumper first aid crews were organized at Idaho City and McCall.



MC-1 type road oil was laid on the takeoff area of the McCall and Salmon airstrips to eliminate the dust hazard and damage to airplane engines.

Storage facilities for insecticide and gasoline were provided at each field. Insecticide and gasoline storage areas were clearly posted and roped off as a safeguard against fire. Loading stations were strategically placed. They were located at least 100 feet apart to allow for maneuvering of planes and for safety of personnel.

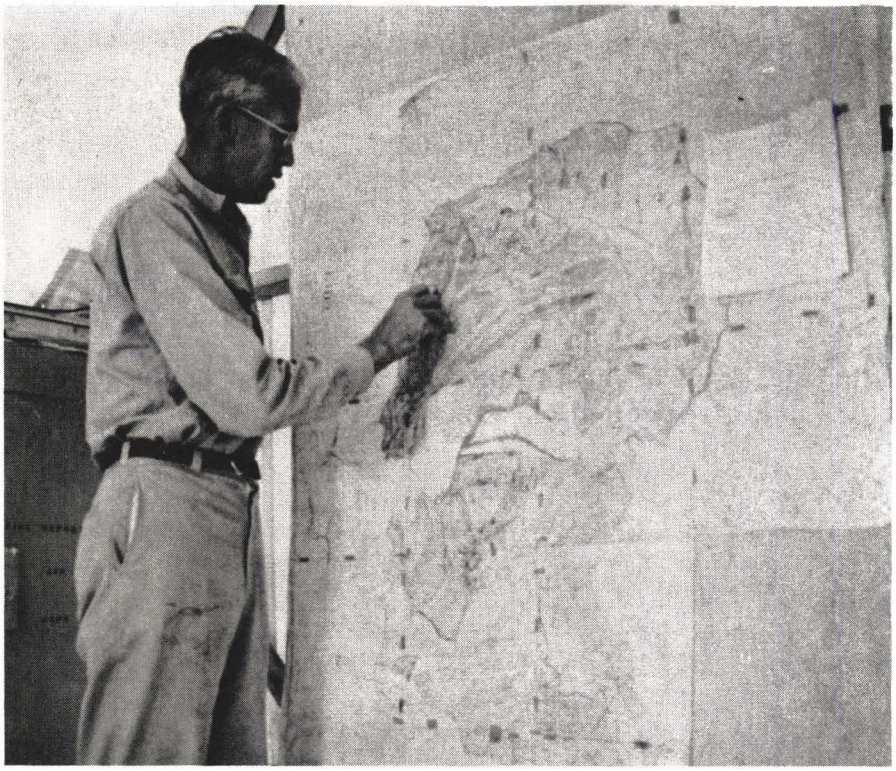
This A-20 was wrecked because of a tire blowout on takeoff. The pilot walked away uninjured. He attributed his safety to the enforcement of the shoulder harness and crash helmet requirement in the contract.



Electrical grounding of airplanes while refueling with gasoline was one of the safety requirements included in the flying contract.

All aircraft, facilitating equipment, pilots, mechanics, ship inspectors and insecticide loaders were furnished by the contractor.

Selection of the airstrips was of prime importance in the overall planning. Photo shows McCall airstrip with insecticide tanks and housing facilities needed for this operation.



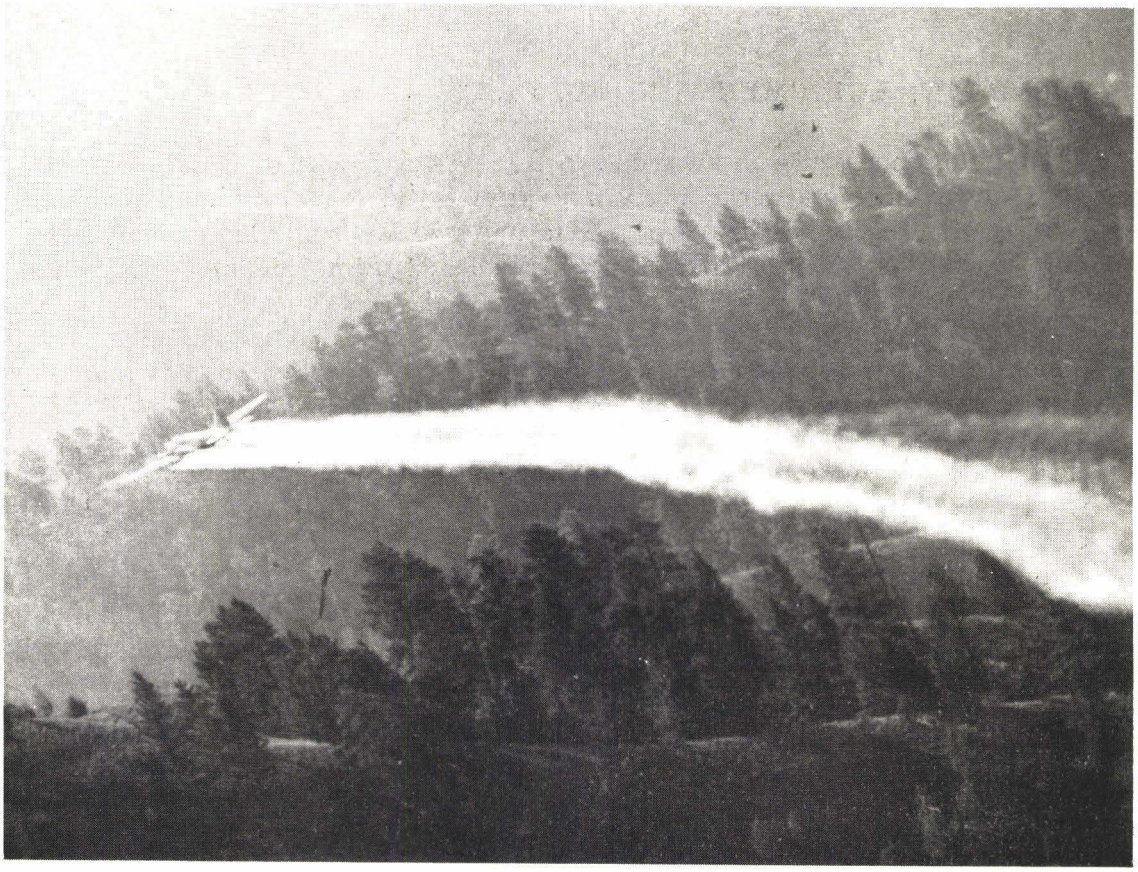
Progress within each control unit was recorded daily on large unit area maps by pilot personnel.

CONTROL UNITS

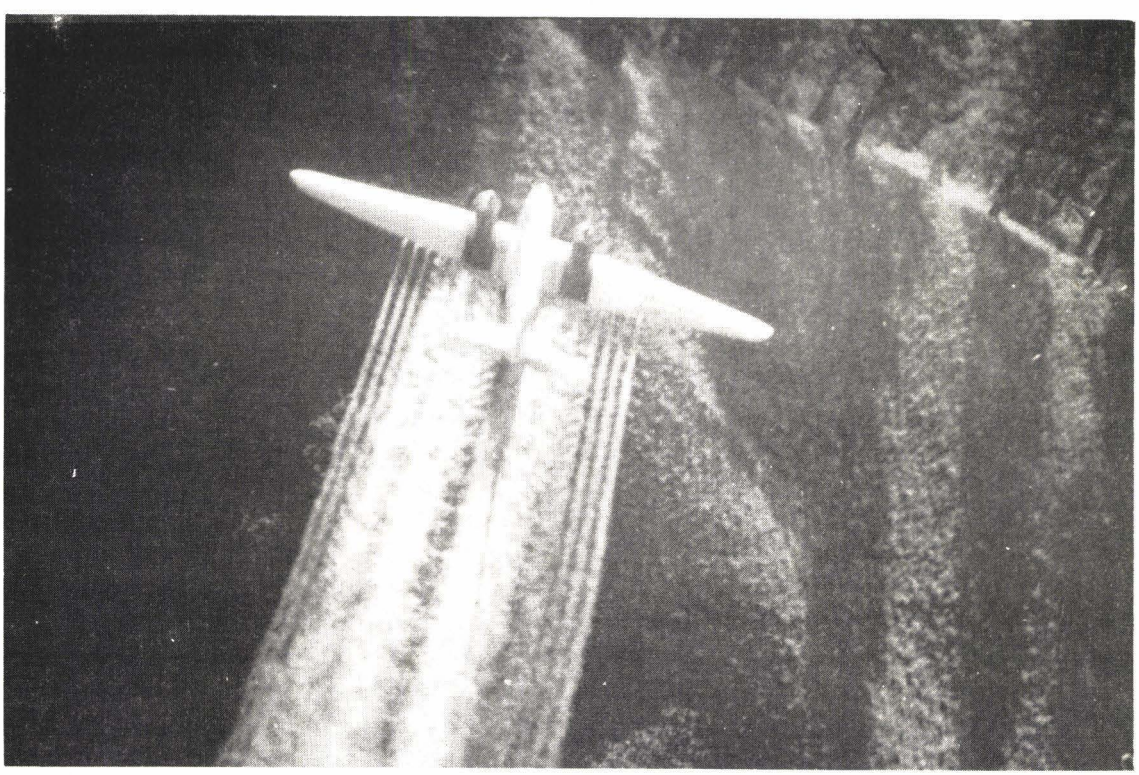
Because of the widespread nature of the planned control project, it was decided to set up control units by national forest areas. These control units were the Salmon, Boise and Payette National Forests. Headquarters and airstrips for each of these units were Salmon, Cascade and McCall.

16,012 acres of new infestation on the Targhee National Forest was added to the Salmon unit. In addition considerable acreage on the Challis National Forest was sprayed out of Cascade on the Boise National Forest.

Aerial photography and timber type maps were used to provide the basic information for spray block designation and progress of control. Forest maps of the quarter and half-inch scale were also very useful for checker personnel and aerial observers.



Because of its ferrying speed, the A-20 was adaptable to long hauls to outlying spray areas. This type of aircraft was not satisfactory in rugged terrain.



AIRCRAFT, EQUIPMENT AND SUPPLIES

The flying contract was awarded to Roberts Aircraft of Boise, Idaho. This contractor started control operation with four converted World War II military aircraft, two A-20's and two B-18's. This spraying capability was later fortified with three Ford trimotors and a Douglas DC-3.

The contract for insecticide was awarded to Pennsylvania Salt Manufacturing Company of Tacoma, Washington.

Interstate Services Company of Vancouver, Washington was low bidder for the transportation and storage contract.

Observation planes included a Cessna 182, a Cessna 172, two Beech Bonanzas and a Stinson Voyager. Planes were equipped with VHF pack back radios which allowed aerial observers to remain in continuous contact with unit supervisor's headquarters.

Facilities for mixing and storing insecticide were provided in Boise by the Pennsylvania Salt Manufacturing Company. Storage capacity of 100,000 gallons of insecticide and 25,000 gallons of concentrate was provided by this contractor in Boise. McCall field storage was 36,000 gallons; storage at Salmon was 40,000 gallons and Cascade had a storage capacity of 24,000 gallons.

After mixing and testing of batches to insure one pound of DDT in fuel oil, the insecticide was delivered to the airstrips by tanker trucks and trailers of the Interstate Services Company. Prompt field delivery of the insecticide was entirely adequate for maintaining field storage capacity.

Under cooperative agreement with city, county, state and federal agencies, major alteration and improvement was accomplished on the airstrip at Salmon. This work included extension, surfacing, drainage and oiling of the runway area. Tire wear on aircraft using this strip necessitated six tire changes during the operation.

The Cascade strip was adequate for use by the lighter Ford trimotors. Maintenance work here included mowing and watering.

The McCall strip was oiled prior to the start of the project to control dust. This treatment was supplemented with daily watering and some rolling. The severe impact on take-off and landings by the fast moving A-20's caused heavy wear on this strip. Graveling and surfacing of foundation material necessitated daily rock pickup during the later stages of the control project. One A-20 crashed on take-off because of tire failure and was completely washed out. Fortunately the pilot of this aircraft was unhurt and was able to resume flying status very shortly.

VHF radios were installed at each unit headquarters for direct contact with ground personnel and the observation ship.

COMMUNICATION

Safety as well as all project activities must be controlled and coordinated. A communication network utilizing both radio and telephone, was established and maintained.

Constant communication during the spraying operations was maintained between the observer and unit headquarters by placing VHF radios in all observer planes at each airfield and at control relay lookout points in the outlying control areas. Ground technicians were also supplied with VHF and SPF radios for reporting insect development and establishment of spray block priorities. A walkie-talkie radio was also furnished with each first aid rescue unit.

All radio traffic was handled in accordance with strict communication discipline. The aerial operation had priority on the air with the exception of fire emergency.

The unit supervisor was kept currently informed of flying conditions, spray behavior, location of spray planes and adherence to spray boundaries.

Close coordination between observer, spray pilot and Unit Supervisor was necessary to assure that the infested area was treated effectively and safely.

SPRAY OPERATIONS

Actual spraying operations started at Salmon and McCall on June 24 and 25 with Cascade following on July 5. Only one day was lost at Salmon and parts of four days at McCall and Cascade due to fog and rain.

There was considerable concern because of plane trouble that insect development would exceed spray capacity. On the final stages of the project and while both the B-18's were down for repair, pupation occurred on parts of three blocks on the east half of the Cascade unit before the blocks could be completed.

The east portion of the Cascade Unit was completed on July 25 terminating the project's aerial activity.

The A-20 with its two 1800 horse power motors fly up the ridges as well as down.

The B-18 flying across heavily wooded area laying down its lethal spray.

Thorough maintenance check of every aircraft at every opportunity assures a safe operation.

Plane	Hrs. Flying Time	Gallonage Sprayed/Hr.	Unit Location
A-20	55:24	1350	McCall
B-18	127:29	1326	Salmon McCall
DC-3	25:46	1926	Salmon McCall
Ford (Large)	87:05	913	Salmon McCall Cascade
Ford (Small)	16:27	787	Cascade

Top kill was quite common in the younger mixed stands. Extensive and repeated defoliation would severely reduce growth, eventually kill the stem.

TECHNICAL DIRECTION

Entomological Aspects of the Project

The entomologists of the Intermountain Forest and Range Experiment Station were responsible for entomological advice in advance of, during the spray project, and for checking of results. During the planning stages the entomologists developed guidelines for the entomological phases, trained and supervised biologists and insect checkers prior to and during the spraying, and collected and analyzed mortality data following the operation to judge the effectiveness of the treatment.

Biologists with assistants were responsible for establishing sample lines in all spray units in order to study larval development. Spraying is more successful when applied during the later larval instars, preferably when most of the larvae are in the 5th and 6th instars.

The basic plan for sampling larval development was formulated on a need to sample elevational zones to allow for variation in rate of development because of temperature and other factors. Collections of 100 larvae were made at intervals along established lines. In

addition spot checks of 50 larvae were made in areas not sampled by regular collection points. Collections from established points must be made regularly and preferably at no greater time intervals than every other day. Larvae from each point were sorted into instars by measurement of head widths. Thus the rate of development was determined by elevational zones and was used as a guide in releasing areas for spraying at the proper time.

Spray Release Data

The date of spraying for each unit was based on the larval development sampling and a forecast was made 10 days in advance of the earliest expected start of the operations. The timing of release for individual spray blocks within a large unit was determined by the same sampling but was made a few days in advance to allow proper scheduling of aircraft.

Card Line Data

Lines established in a manner similar to that for sampling larval development served to check spray deposit. Cards about "x" are treated with an oil soluble red dye. When spray droplets, which are oil solutions of the insecticide, descend and deposit on the cards they form light colored spots against the red background. Thus, relative size and numbers of droplets are apparent. By comparison with prepared standards approximate dosages per acre are determined.

Mortality Line Data

Mortality lines consisting of 10 sample plots about five chains apart were established at right angles to the contours. At each plot site just prior to spraying ten branches 15 inches long (two branches from each of five trees) were carefully clipped over a collecting cloth and each tip was carefully examined for larvae or pupae, if present. About ten days after spraying the same procedure was followed in the same trees except that 20 branches (four from each of five trees) were examined. The percent mortality was obtained from the following formula:

$$\%\text{Mortality} = \frac{\text{Before Spray Count} \times 2 - \text{After Spray Count} \times 100}{\text{Before Spray Count} \times 2}$$

Large spray units are subdivided into smaller blocks to facilitate scheduling of spraying. Attempts are made to sample larval development, spray

deposit, and mortaility in as many blocks as possible, taking into account physical characteristics of the terrain, time, and available manpower. Some blocks may be checked for all three of these points while others may be checked for only one or more. There are physical limitations in the amount of sampling that can be done. Experience during spray projects since 1947 has shown that the systems for sampling populations, spray deposit, and mortality are quite satisfactory within these limitations. The spray units in southern Idaho in 1956 were designated as follows:

Unit	Forest	Acres	No. Spray Blocks
I	Salmon	139,805	27
II-E	Boise	145,149	26
II-W	Boise	76,823	21
III	Payette	98,112	24
Added	Targhee	16,012	5
		475,901	103

RESULTS

In operations of this size it must be expected that not all will run smoothly. Erratic development of larvae can complicate releases making it necessary to split blocks, break down of aircraft at critical times can make it impossible to keep up with development so that pupation occurs before spray can be applied, and areas may be inadequately covered for one reason or another.

The results of the 1956 project are summarized in Table 1. It is apparent that in four of the units the results were satisfactory. The results in Unit II-E on the Boise National Forest are not considered satisfactory at 85.2 percent mortality. By the nature of the system of averaging mortality over an area of 145,149 acres it is likely that portions of the area showed satisfactory control while others were far below below the level desired. Special attention will be given to surveys in this unit to determine the level of populations during the next few years.

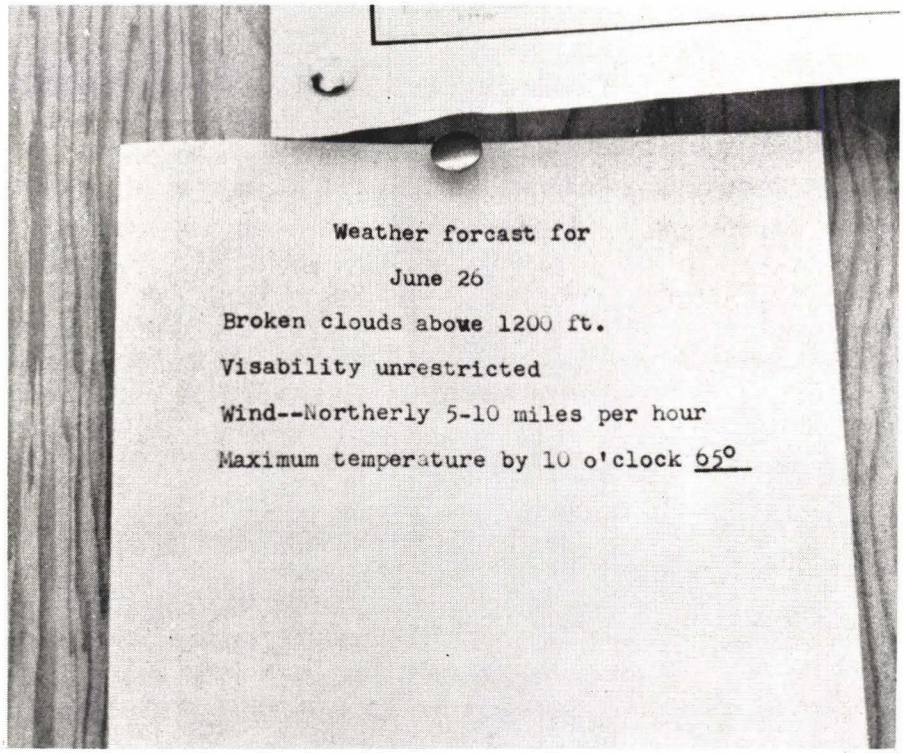
TABLE 1. SUMMARY OF RESULTS OF 1956 SPRUCE BUDWORM CONTROL PROJECT

Unit	Forest	Spray Acreage	No. Spray Blocks	No. Larval Develop Collec. Plots	No. Larval Develop Spot Checks	No. Card Lines	No. Mort. Lines	%Spray Block Sampled Mort.	Range of Percent Mort.	Ave. % Mort.
I	Salmon	139,805	27	27	11	12	20	74	80.7-100	94.7
II-E	Boise	145,149	26	35	31	14	17	65	43.4-100	85.2
II-W	Boise	76,823	21	15	62	22	20	77	91.8-99.3	96.8
III	Payette	98,112	24	26	12	12	12	50	86.0-100	96.2
Added	Targhee	16,012	5	--	4	5	1	20	95.6	95.6
Total		475,901	103	103	120	65	71	69	43.4-100	92.20*

*Average percent mortality less unit II-E--95.4

Checking rate of insect development was a very important phase of the ground program that governed the aerial application of lethal DDT.

Lines were established prior to spraying to facilitate gathering of essential mortality data.



Daily forecasts of weather proved invaluable.

COOPERATION

The project involved the cooperation and participation of the State of Idaho Department of Forestry, South Idaho Pest Action Counsel, Idaho Department of Aeronautics, Civil Aeronautics Authority, United States Weather Bureau, Idaho Fish and Game Department, Agricultural Research Service and many other groups and individuals. Weather Bureau personnel gave current forecasts of weather conditions for control unit.

The State Department of Forestry cooperated by setting up a zone of infestation and getting approval by the State Land Board and depositing funds sufficient to pay the State of Idaho proportionate share for private lands as well as financed the spraying cash on all state lands.

Cooperation of the State Fish and Game Department was invaluable in keeping the sportsmen of the state informed as to the effects of the spraying operations on fish and wildlife. Members of the game department and the game commission participated in observation of the spraying job to acquaint themselves with the care taken to prevent loss of fish or fish food organisms in streams. Members of the game department efficiently and tactfully handled many complaints relative to misinformation on the effects on the fish population.

Mr. Archie Gieser of the Agricultural Research Service was available during most of the project and participated in flight training, inspection of spray planes, and facilitating equipment.

Federal C. A. A. personnel participated in general aerial safety inspection of planes, fields, and flying personnel before and during the actual control operation.

The South Idaho Pest Control Counsel cooperated with the Forest Service and contributed valuable assistance to help plan and initiate the control job.

Chet Moulton of the Idaho Aeronautics Department cooperated in flying safety and assisted in the planning and reconstruction of the Salmon Municipal landing strip.

The B-18 proved to be quite adaptable as a spray aircraft in rough terrain, in operation from "country" airstrips, and has good ferry ability and load capacities.

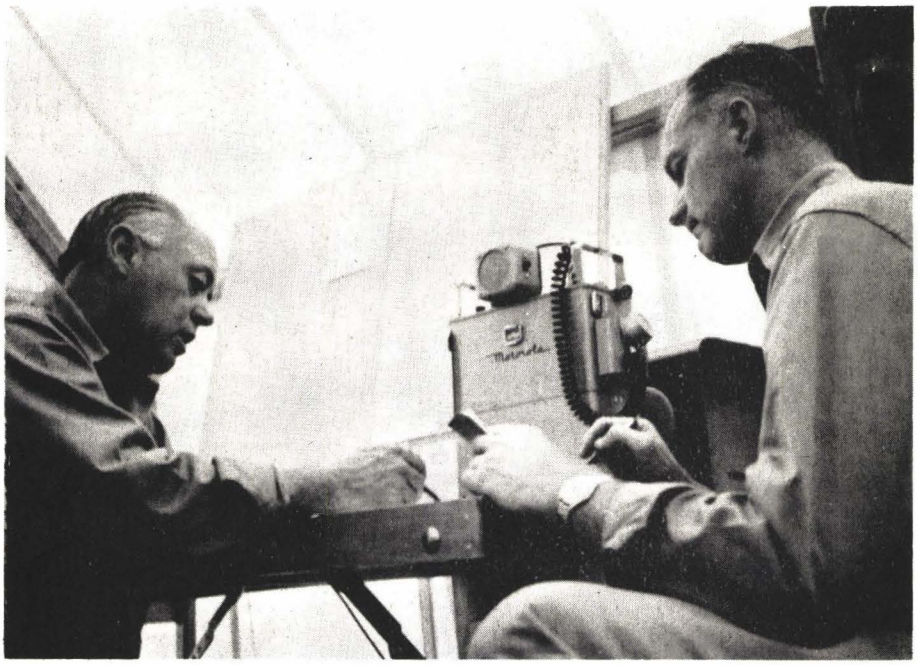
PUBLIC RELATIONS

A special informant booklet, prepared by the Regional Office, covering all phases of the 1956 control project was given general distribution. Many visitors and other key individuals were shown ground and aerial operational phases through interviews and personal contacts with each unit supervisor.

Local newspapers printed short progress reports during the project. Regional Office and forest personnel cooperated to insure this publicity coverage. District rangers within the control area handled the informational and educational program on their own district. A definite attempt was made to inform outlying individuals and committees when spraying was imminent.

Close liaison with public and private agencies and groups was maintained throughout the project. Special cooperation between project personnel and the State Fish and Game Department was also very effective.

The colored moving picture "Attack from Above", made through cooperative efforts during the 1955 control project, proved to be a very effective training aid and informational film.



Keeping records, and coordinating the flying is one of the most important phases of the control project.

MISCELLANEOUS FINDINGS

1. Insert penalty clauses in the contract in case the operator is not set to go on the day the project is to start.

2. Insert penalty clauses in the contract if standby aircraft cannot be obtained as called for in the contract.

3. For each spray aircraft with a spray airspeed greater than 160 air miles per hour a supplemental spray aircraft of a speed less than 110 spray air miles per hour must be furnished to fill in hazard areas.

4. Where one operator has more than one unit it should be permitted to allow one chief pilot to oversee and coordinate the operations.

5. On untried spray aircraft the contract should restrict the acceptance to one spray aircraft until the craft is proven.

6. The responsibilities involved in the unit supervisor's job require the selection of an individual with sufficient qualifications to perform his duties with a minimum of training.

7. In view of the increased use of heavier and faster aircraft, intensive airstrip maintenance must be recognized and planned for prior to the start of operations.